Geophysical surveys to assist the INSTAR Boyne Valley Landscapes Project at the Brú na Bóinne World Heritage Site, County Meath, Ireland.

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Historically aerial photography, and latterly LiDAR, have been used to identify and map new sites in the Brú na Bóinne World Heritage Site (WHS), an internationally significant archaeological landscape known for its Neolithic passage tombs, other monuments and megalithic art (Fig 1). The landscape is largely composed of the floodplain and terraces of the River Boyne which are farmed in a combination of pasture and tillage crops.

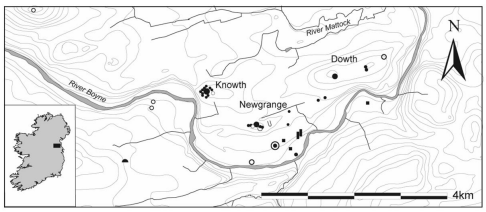

Fig 1: Location of the Brú na Bóinne WHS and its Principal Visible Monuments

The INSTAR (Irish National Strategic Archaeological Research) Boyne Valley Landscapes Project is a response to some of the key issues to be addressed in the research strategy published in the Brú na Bóinne WHS Research Framework (Smyth, 2009).

Key issues to be addressed where geophysical survey can be of assistance include:

- Reconstruction and modelling the palaeoenvironment and landscape development
- Establishing the nature and extent of later prehistoric activity
- Understanding the structural sequence and phasing of the passage tombs
- Investigating the sequence of monuments between Newgrange Passage Tomb and the River Boyne
- Integrating monuments and landscapes
- Understanding land-use change
- Investigating the archaeology of the River Boyne

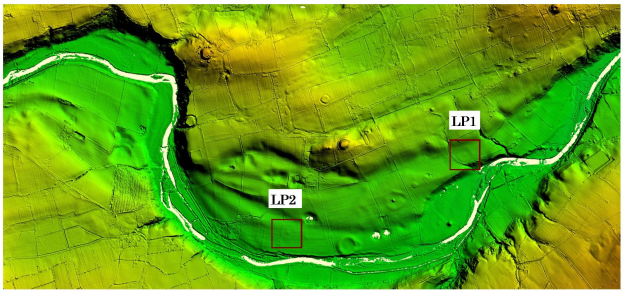

Fig 2 LiDAR image showing the core area of Brú na Bóinne WHS and low topographic profile sites LP1 and LP2

The project is developing an integrated and comprehensive landscape archaeological model for the Boyne Valley, with a focus on linking changing land use and environment to the known landscape of ancient monuments and settlement. The project has aimed to collate all available landscape and environmental data into a GIS database for modelling purposes, and to use this database to identify zones of likely change in the natural and cultural landscapes. Ground-truthing of specific zones of the river system against the model developed from the GIS database is being carried out, and then integrated into the GIS, providing a comprehensive dataset for and model of landscape and river history in the Boyne Valley.

Ground-truthing involves a combination geophysical survey and coring to obtain material for sedimentological and geochemical analysis and for radiocarbon dating. Surveyed zones, targeted by landscape analysis using LiDAR., include identified sites as well as previously unrecognised sites with high archaeological potential

Acknowledgements

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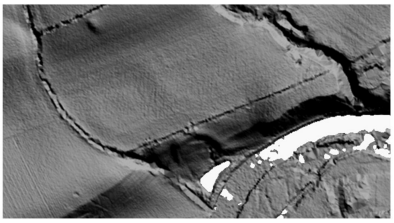

Fig 3 LiDAR image of site LP1

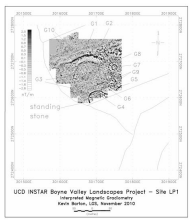

Fig 4 Selected gradiometry results

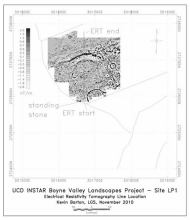

Fig 5 ERT line location

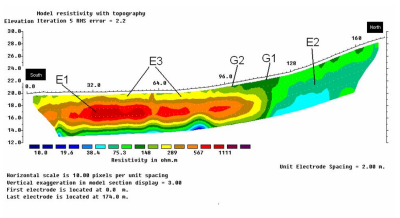

Fig 6 ERT Results

The gradiometry results (Fig 4) partially map the northern part of LP1 (Fig 3) where there appear to be two parallel curving ditches (G1 & G2). The remaining part of the topographic anomaly (G3) does not have a strong magnetic expression. This may be due to the nature of the sediments on the lower part of the sloping terrace and/or agricultural activity. There are two previously unrecognised features at the south and at the east of the survey area. The southern feature is presently interpreted as a sinuous ditch (G4 & G5). G6 could be the remnant of a drain forming an old field boundary which runs parallel to the current boundary The eastern feature is a circular ditch (G7) some 15m in diameter possibly enclosed by a ring of pits (G8) giving an overall diameter of some 30m.
To the south there are a number of unresolved short linear and arcuate features (G9). To the north-east of the survey area there appears to be a number of linear features trending northeast to south-west towards the northern double ditch feature (G10).

The south to north ERT transect location is shown overlain on the magnetic gradiometry image (Fig 5). The modelled pseudosection with draped topography is given in Fig 6. The topography draped on the section has an x3 vertical exaggeration. There are two main features seen in the section with a higher resistivity 'lens' lying in the lower ground (E1) and low resistivity material forming the higher ground (E2). There is an approx. 10m height variation between the lower ground to the south and the higher ground to the north. There is an intermittent, thin lower resistivity veneer of variable thickness lying on the 'lens' (E3). Lower resistivity is also seen under the 'lens'. The intermediate resistivity zone from 100m to 122m along the section seems to correlate with the strong double ditch feature seen in the north of the magnetic gradiometry data (Fig 4; G1 & G2). From the magnetic gradiometry data; G2 lies at 99m along the section and G1 at 116m. The next step in the investigation of this site is a coring transect based on the geophysical results.

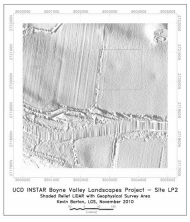

Fig 7 LiDAR image of LP2

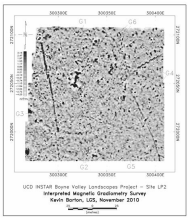

Fig 8 Gradiometry results

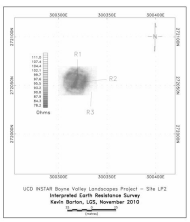

Fig 9 Earth resistance results

In the gradiometry results (Fig 8) the central feature (G1) is some 16m in length with curving 'terminals' at both ends each some 7m in length. The width of the feature is less than 2m.
G1 is enclosed by a discontinuous band of positive gradient (G2). The feature is presently interpreted as a ditched oval enclosure and is truncated to the west and north by a road and field boundary respectively. The discontinuous nature of the anomaly prevents any recognition of possible entrances. There are a number of linear features cutting, running close to or possibly overprinting the oval enclosure. G3 is a ditch cutting the enclosure and is possibly a remnant field boundary. It has a small offset where it cuts and possibly overprints the southern element of the enclosure which may indicate that it postdates it. G4 indicates two slightly curving ditches intersecting at ninety degrees on or close to the eastern circuit of the enclosure. They may be remnant field boundaries. G5 is a linear that partially cuts across the southeast sector of the enclosure. Its discontinuous nature makes it difficult to interpret its function; it could be related to an entrance to the enclosure. G6 indicates two possible discontinuous enclosing elements of a small oval feature. The feature appears to lie within or slightly overprint the north eastern sector of the large oval enclosure. There are a number of pit-like features within and without G6 and also small, subtle linears which might be related to an entrance in the south east.

The resistance results are given in Fig 9. R1 maps the central feature as seen in the magnetic gradiometry data (G1). The feature has the lowest resistance measured during this survey. The next highest resistance is denoted by R2 which takes the form of a circular or slightly ovoid area enclosing R1. R3 denotes the highest resistance which surrounds R1 & R2. The resistance contrasts found here clearly define R2 as an enclosing element of R1 within the background soil resistance of R3. We currently interpret these results as being due to a destroyed passage tomb. The next step in the investigation is a larger scale earth resistance survey followed by an ERT transect.